MSE 497/597: Introduction to Nuclear Materials, Spring 2019

**Project #1:**

**Review Paper on Exploratory Research in Nuclear Systems**

In the nuclear R&D world, discussions on fundamental, or “core” concepts require knowledge and understanding of specific acronyms, jargon, caveats, and lessons learned. One way to gain an appreciation for the real challenges in the nuclear R&D field is to investigate a specific example. So far in class, we have discussed multiple reactor types (including power reactors, test reactors, and research reactors), opportunities for materials investigation and research, neutron interactions with materials (such as half value thickness), and decay. Each of you will choose a topic/issue from the list below (or get a topic/issue approved from me) and draft a short paper.

Your assignment is to write a short paper that explores the current state of the field through peer reviewed published literature (this means using Google Scholar, Web of Science, Compendex, etc.). For this assignment, you will need to survey the current literature and write a short review paper summarizing the causes of the topic/issue (for help on what a review paper might entail and how to approach it, take a look at the website: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3715443/>). Your review should briefly summarize how the issue/topic impedes nuclear power generation, what is being currently researched, and how the issue could be solved. This paper should contain the following sections:

* ***Abstract*** – No longer than 150 words to briefly summarize your paper and your most important findings.
* ***Introduction*** – to introduce the topic/issue and puts the paper in context to highlight its importance in the light of nuclear power production, which materials it affects, and what components of the reactor are involved.
* ***Review Section*** – to show the current efforts in this area. This may include current research on mitigation strategies or research that demonstrates the issues.
* ***Discussion Section*** – This is where you will reflect on the review and extrapolate possible strategies or developments, including how you expect that the issue will be solved, what possible implications of a solution might entail, and how it will affect reactor operations.
* ***Summary Section*** – This is where you briefly reiterate the highlights of your review.

This project must be between 3-5 pages including figures, tables, and references. The text should be single spaced, size 11 Times New Roman font, and include 1 inch margins all around. It must include at least 6 peer reviewed references formatted using the Journal of Nuclear Materials formatting.

Due Dates:

10% Topic due via email **February 11, 2019** (Monday)

25% First Draft Due on BB **February 20, 2019** (Wednesday)

n/a Handed to peers February 22, 2019 (Friday)

25% Peer-Review Due **February 27, 2019** (Wednesday)

40% Final Draft Due on BB **March 6, 2019** (Wednesday)

# Project Topics

Choose one of the topics/issues from the following list or email me for approval:

* Irradiation-Assisted Stress Corrosion Cracking
* Embrittlement of Reactor Pressure Vessel Steels
* Pellet cladding chemical/mechanical interactions in LWRs
* Creep of structural materials in LWRs
* Grid-to-rod fretting (GTRF) in LWRs
* Iodine-induced stress corrosion cracking in LWRs
* Spinodal decomposition in welds of core structural components in LWRs
* Hydriding of Zircaloy fuel cladding in LWRs
* Steam generator primary water stress corrosion cracking in PWRs
* Pressurized thermal shock of the vessel in BWRs
* Void Swelling in Stainless Steels
* CRUD formation and CRUD-induced power shift
* Oxide dispersion strengthened (ODS) alloy development, challenges, and advantages for fast reactor applications
* Fission product generation and corrosion of core materials in molten salt reactors
* PBMR: TRISO particle barrier layer fission product interaction
* Metallic fuel-cladding eutectic formation in sodium cooled fast reactors
* Liquid metal embrittlement of ferritic/martensitic steels in liquid metal fast reactors

Here are some considerations of mine when I am grading:

1. The main bullets points that I use are:
   1. Did you demonstrate critical thinking
   2. Effective communication through writing?
      1. clarity, conciseness, references, does it flow well etc.
2. Remember, this is a technical paper based on scientific evidence. Be careful with using adjectives (nasty, huge, very, etc). Do not use I, we, our, my, etc.
3. Demonstrate Critical thinking . . . don’t just regurgitate info or write off the top of your head . . . that is not the purpose of this project
4. Do not use conjunctions in a technical document
   1. do not instead of don’t, is not instead of isn’t, etc.
5. Reputable citations (use them in the text). Wikipedia is NOT one of them.
   1. How to cite data inserted from another source:
      1. Use a thought (reference your sentence)
      2. use a phrase: use quotes and then cite
      3. use of a sentence or more indent body, use quotes, have a reference.
6. Figures do not belong if they are not specifically referred to and called out in the body of the paper
7. Make sure that there are smooth/logical transitions between sentences and paragraphs. Make them flow more nice and fluent
8. Read your papers before you turn them in! There are no excuses for misspelled words or nonsense sentences.